Comparing two state-of-the-art models, MOZART-3.1 and GMI Combo

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MOZART is a community model

Development: NCAR, NOAA/GFDL, MPI-Meterology
(UIUC is also a partner in the MOZART team)

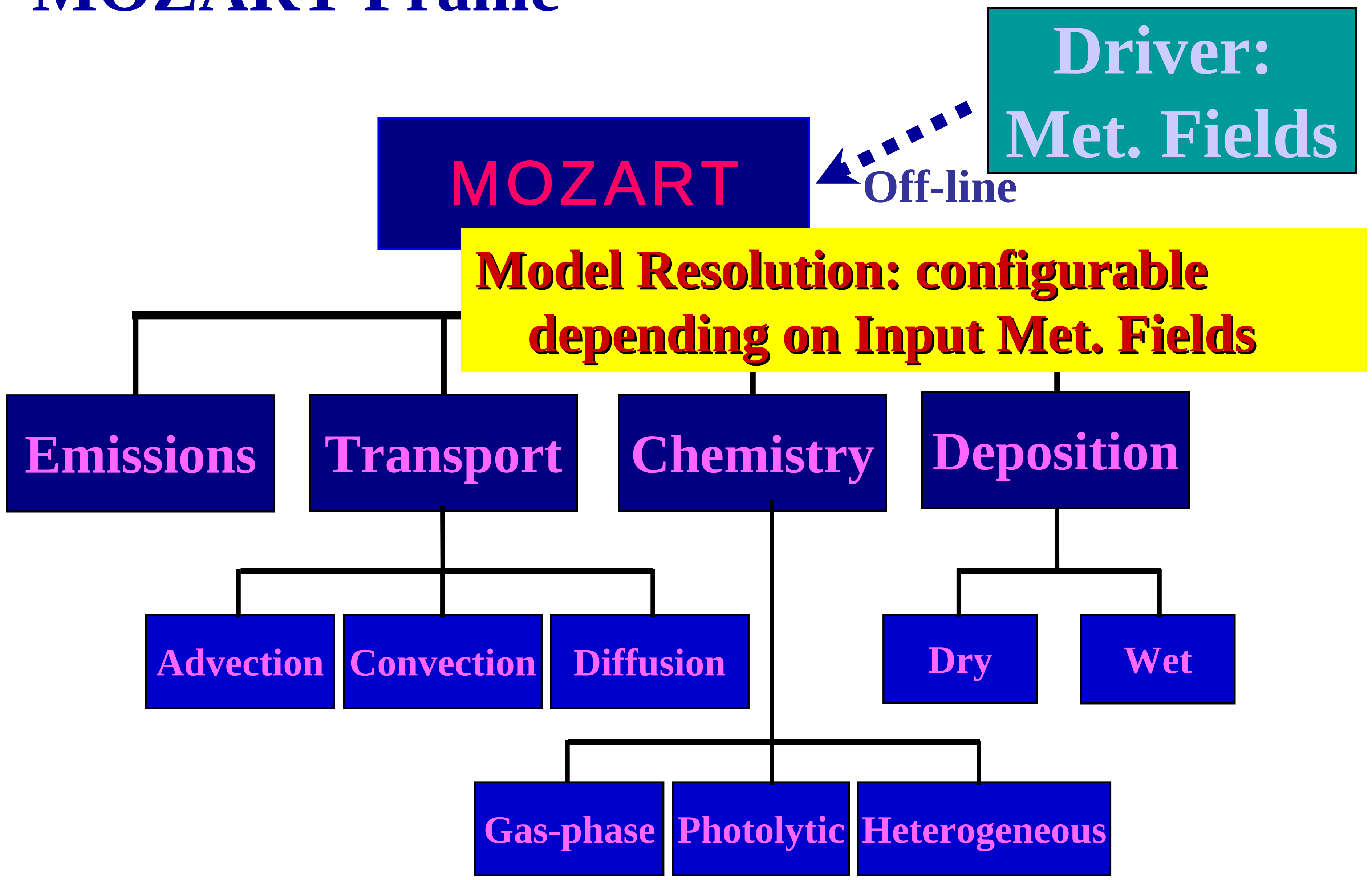
A community tool capable of:

- Understanding the influence of chemical and transport processes on the global distribution of chemical compounds in the atmosphere.
- Quantifying the global and regional budgets of these compounds.
- Assisting in the interpretation and assimilation of various measurements.
- Predicting the evolution of the atmospheric composition in response to natural and human-induced perturbations

Current Versions

MOZART-2.4: Tropospheric version (Horowitz et al., 2003)
MOZART-3.1: An extension of MOZART-2 into stratosphere and mesosphere
MOZART-4: An updated version of MOZART-2.4, including a number of improvements

MOZART Frame



Chemistry Module for MOZART-3

106 species; 260 thermal, 66 photolytic and 18 heterogeneous reactions for whole atmosphere

1. Middle Atmosphere: detailed neutral chemistry model

50 Species; 118 Gas Phase, 50 Photolysis, 18 Heterogeneous Reactions

Ox, HOx, NOx, ClOx, and BrOx Chemical families + CH_4 chemistry

Heterogeneous processes on 4 aerosol types: liquid binary sulfate (LBS), supercooled ternary solution (STS), nitric acid tri-hydrates (NAT), and water-ice aerosols

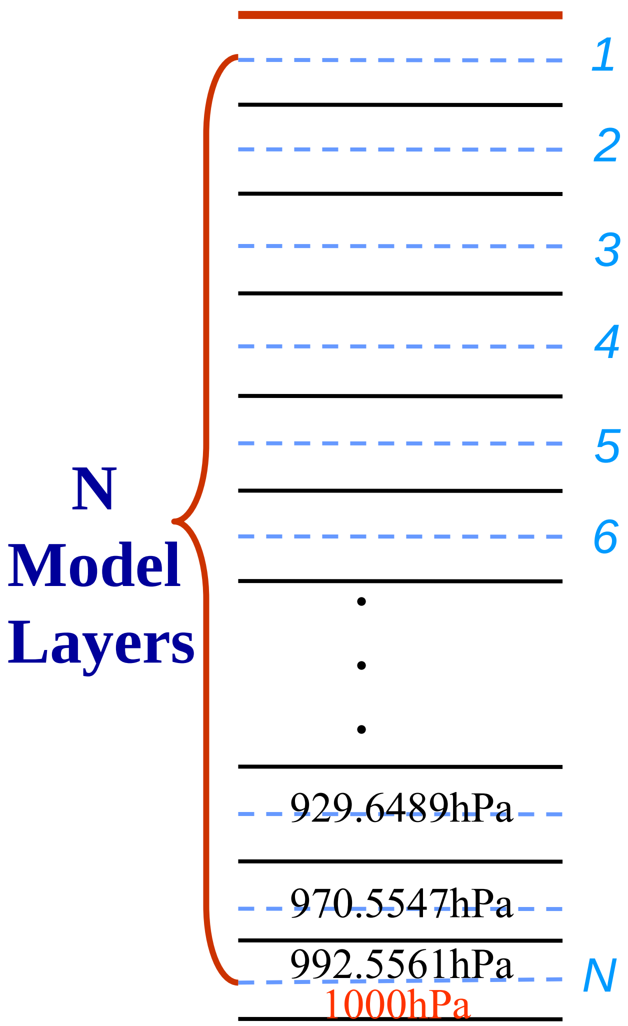
2. Troposphere: updated from the MOZART-2

Ox, NOx, HOx, CH4, C2H6, C3H8, C2H4, C3H6, more detailed HCs

improvements to tropospheric NMHC reaction mechanism

♫♪ Gas-phase and photolytic reactions can be modified through the model preprocessor and STUV-based LUT generator. ♪♫

Met. Fields for MOZART



Hybrid (p-σ) or σ-Coorinate

Preprocessor

Met. Fields
(GCMs, Assimilated/Analysed Data)

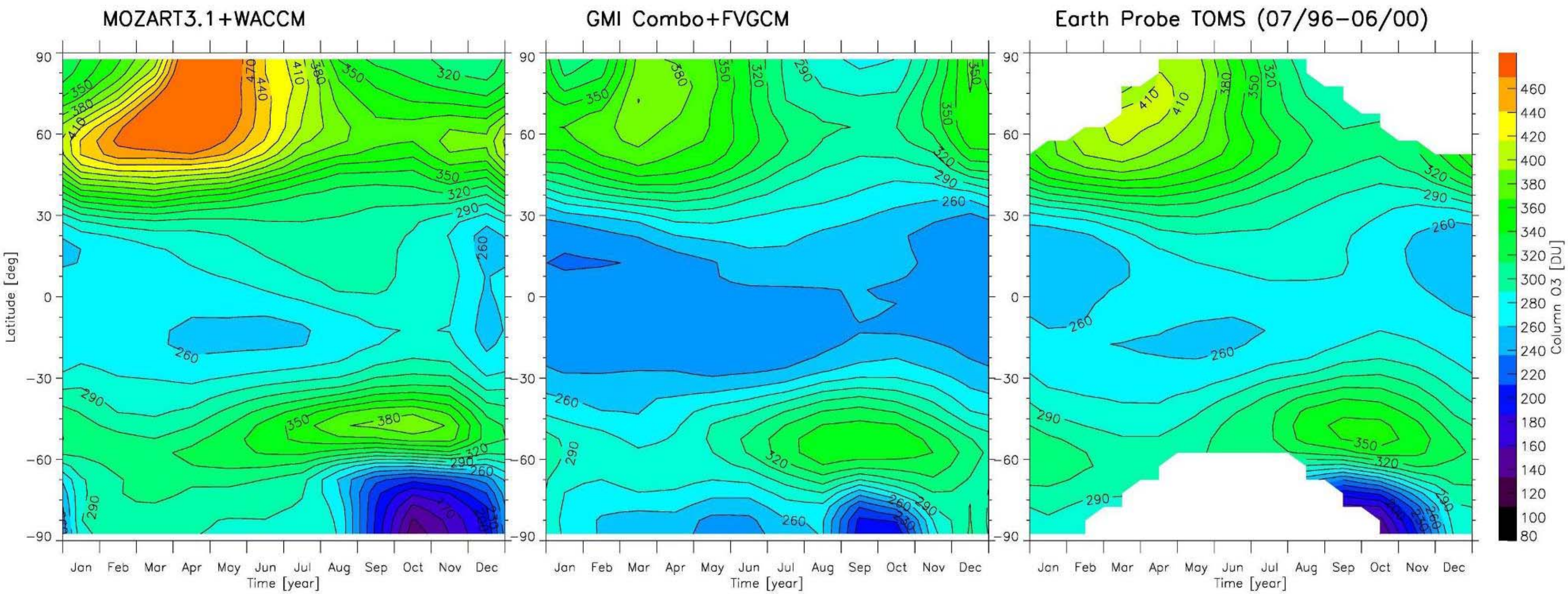
Atmospheric Data:
U,V,T

Surface Data:
P_s, T_s, Φ_s, τ_x, τ_y, Qflx, SHflx, Orography, FSDS, …

MOZART can be configured to use the original resolution of Met. Fields!

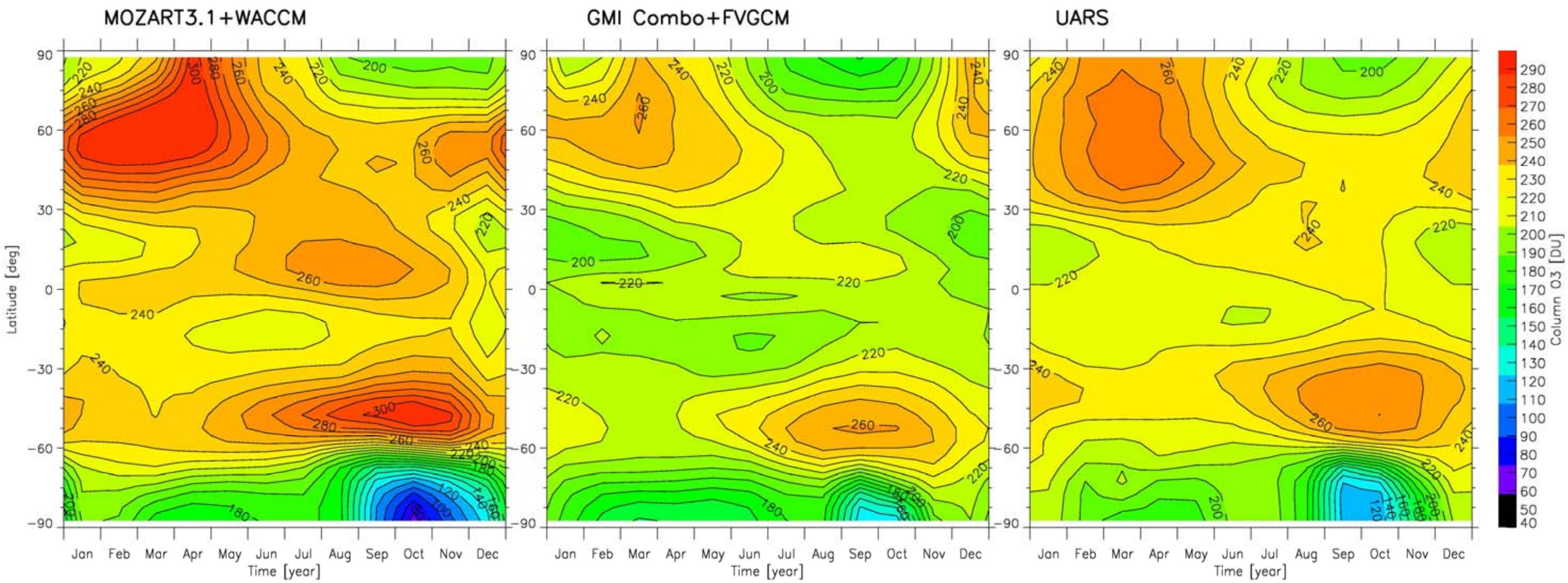
Otherwise, Met. fields need to be interpolated to the predefined MOZART resolution!

Time-Latitude Crossections of Total Column Ozone [DU]



- **Both simulations show reasonable agreement with observation, but MOZART+WACCM1b has higher values over higher TO3 regions.**
- **GMI Combo + FVGCM output shows generally lower values than observations.**

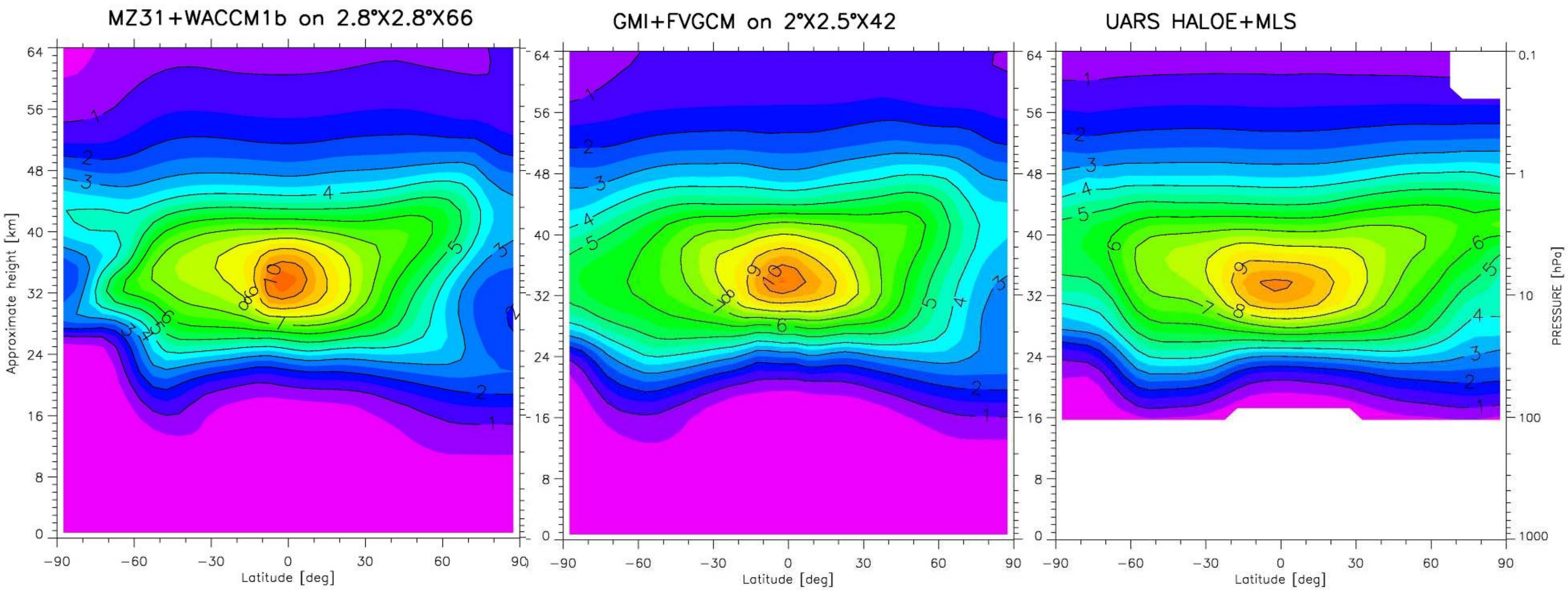
Stratospheric Column Ozone (16-48 km) [DU]



➢**MOZART3.1 + WACCM1b : higher stratospheric column O3 => ?**

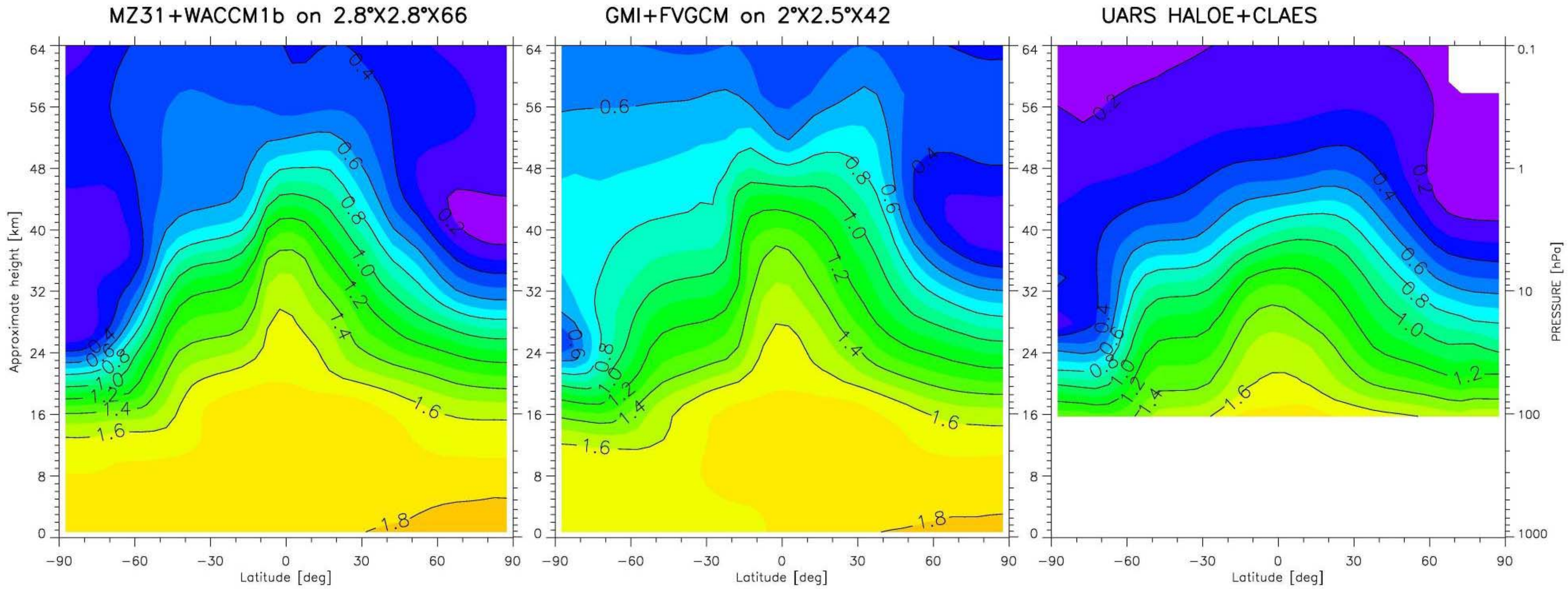
➢**GMI Combo + FVGCM : lower stratospheric column O3**

Latitude-Height sections of zonal-mean O_3 [ppm]



Adjusted j-values to be consistent with our 2-D model

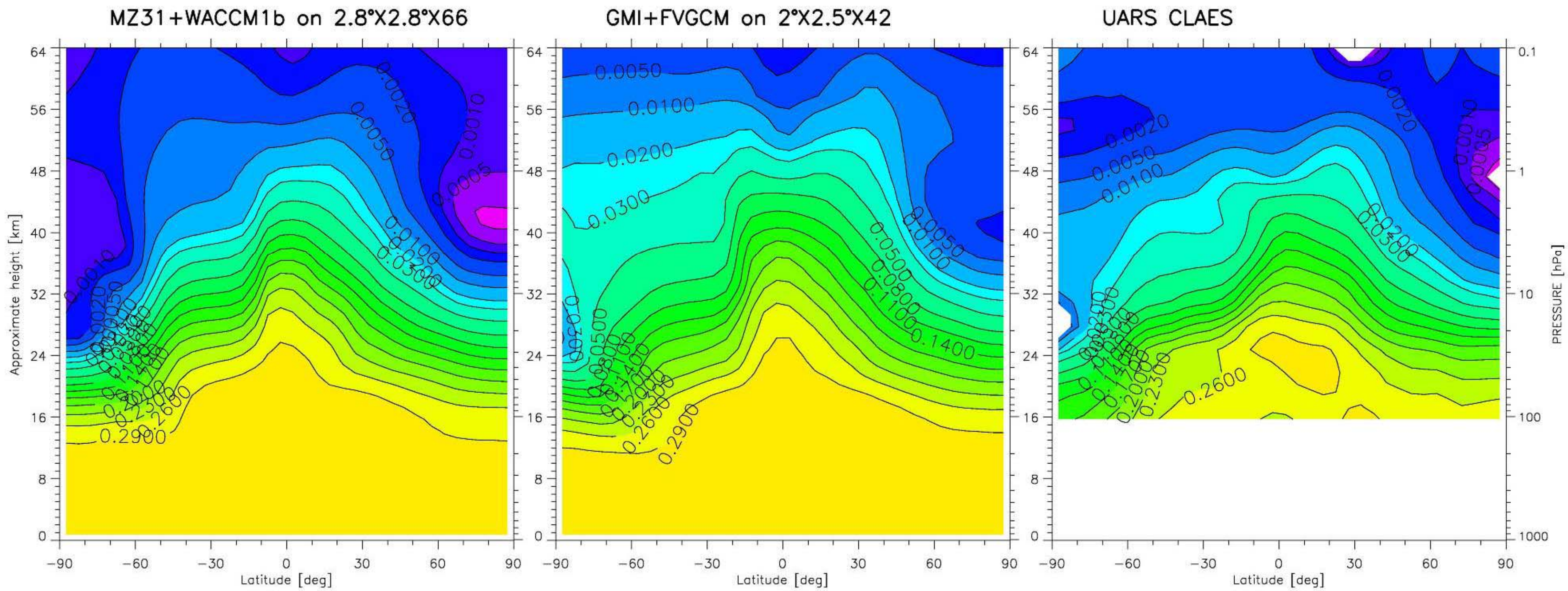
Latitude-Height sections of zonal-mean CH_4 [ppm]



➢**Both simulations have narrow tropical pipe (steep horizontal gradient at the subtropics).**

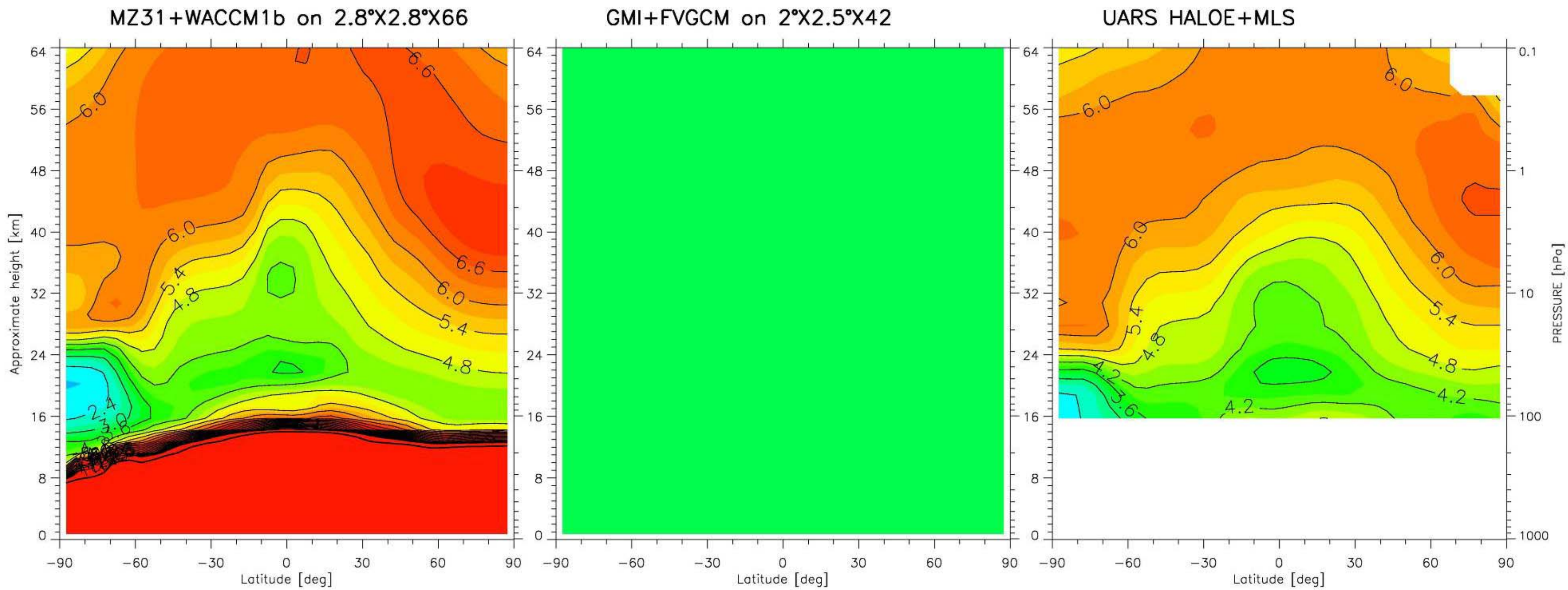
➢**GMI Combo + FVGCM : smaller vertical gradient in the upper stratosphere.**

Latitude-Height sections of zonal-mean N_2O [ppm]

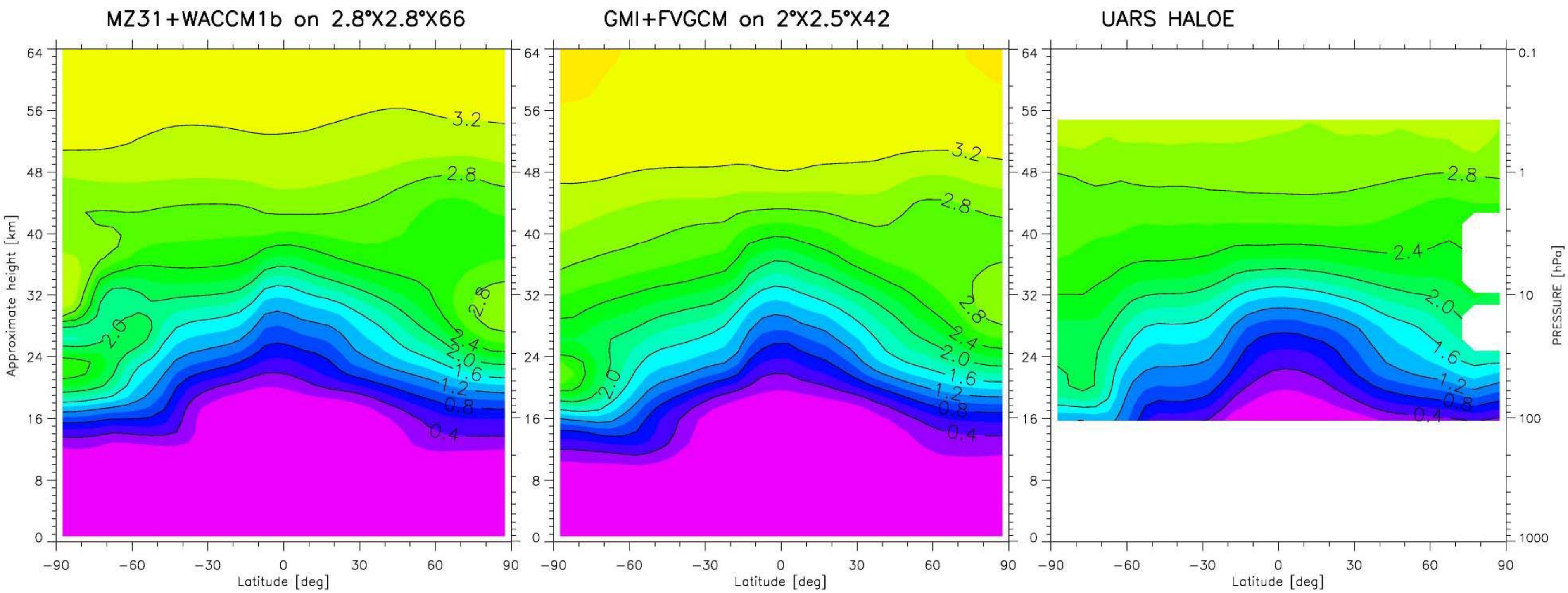


- **General pattern of CH4 and N2O distributions, followed by B-D circulation, are in agreement with observations.**

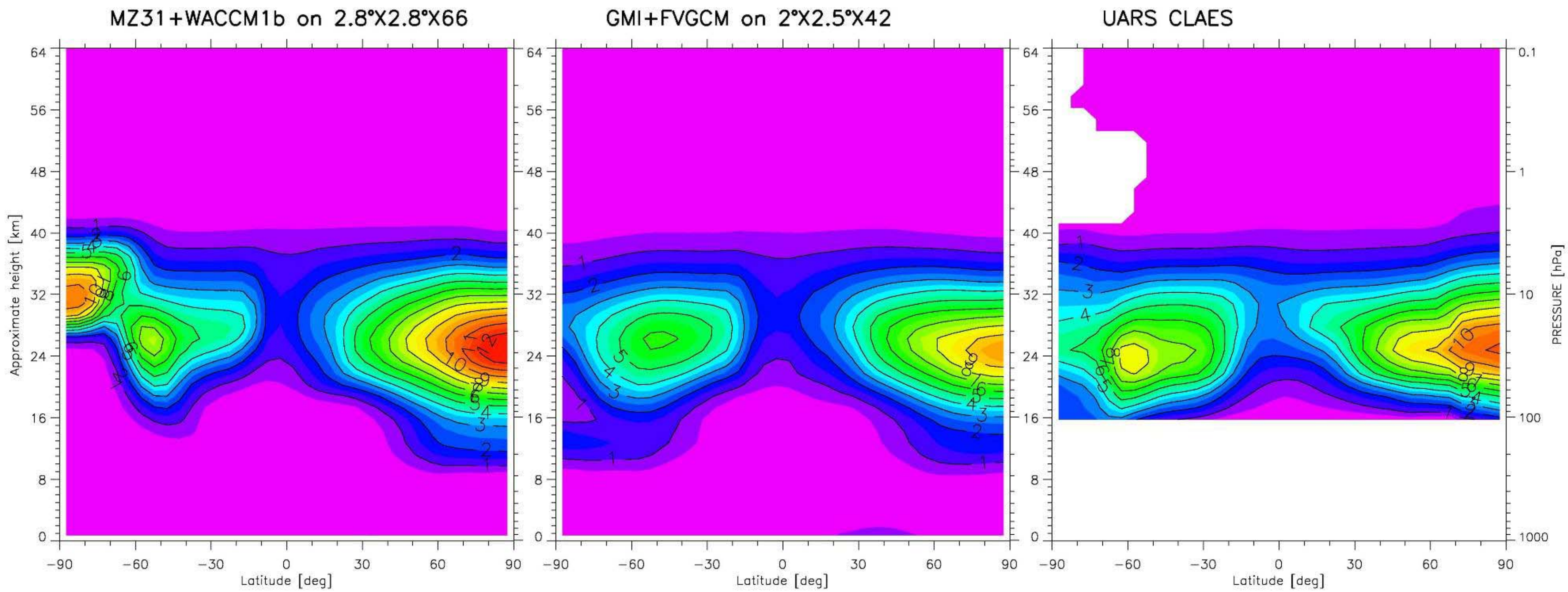
Latitude-Height sections of zonal-mean H_2O [ppm]



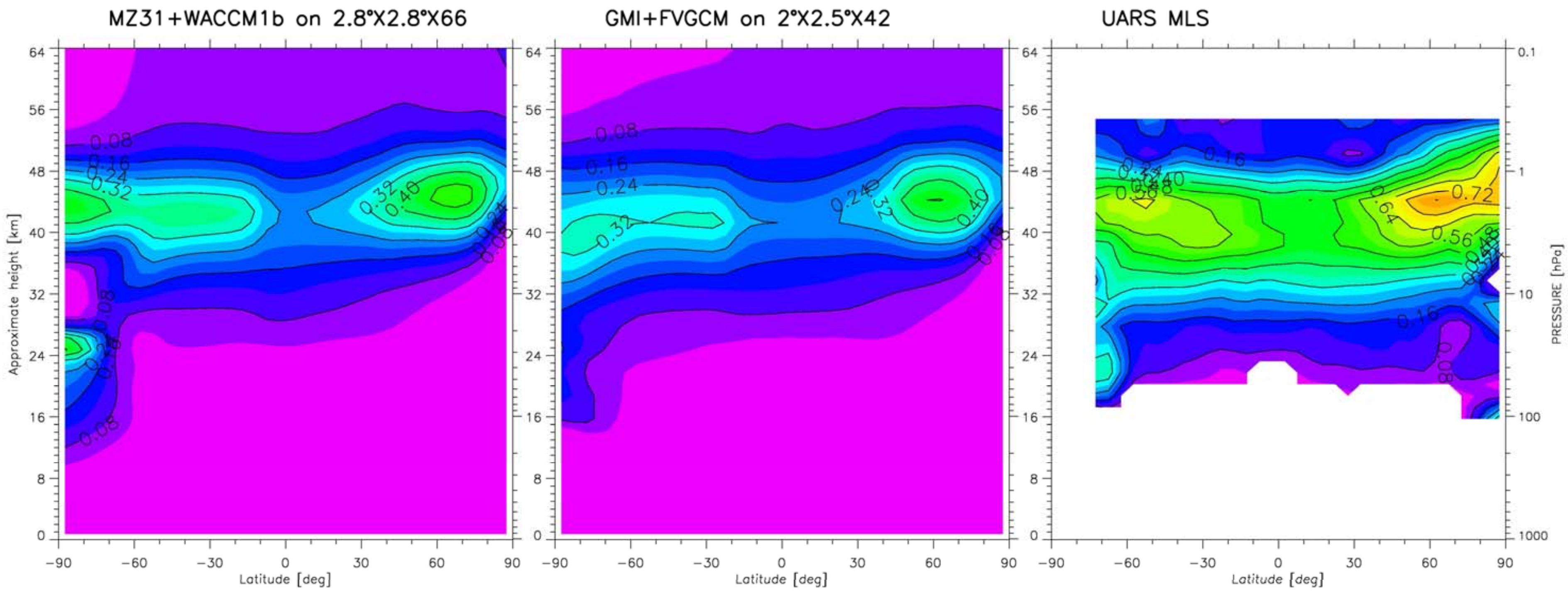
Latitude-Height sections of zonal-mean HCl [ppbv]



Latitude-Height sections of zonal-mean HNO_3 [ppbv]



Latitude-Height sections of zonal-mean ClO [ppbv]



What to do more

Compare the simulations derived with same meteorological fields including FVGCM, and possibly WACCM3 and ECMWF for better comparison.

Compare near-troposphere region (UT/LS Region) using more available observations from satellites, aircrafts, and radiosonde.